Entrepreneurs, Jobs, and Trade*

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Abstract

We propose a simple theory of personal income distribution, equilibrium unemployment, and trade with perfectly competitive product markets and labor markets exhibiting search related frictions. Individuals with high managerial talent choose to become self-employed entrepreneurs and acquire more managerial capital, whereas low talent individuals become workers and face the prospect of unemployment. We analyze the effects of trade liberalization and job-creating policies within the framework of a small-open jobless economy and a two-country global economy. In the case of a small-open economy, improvements in international competitiveness raise the possibility of immiserizing, jobless, and unfair recoveries with higher GDP, higher unemployment, worse personal income distribution, and lower welfare. Reductions in the costs of acquiring managerial capital or appropriate job-vacancy subsidies generally lead to lower unemployment rate, higher aggregate welfare, and worse income inequality. In a two-country global economy, a country exports the good with lower labor-market frictions or lower costs of managerial capital acquisition. Unilateral job-creating policies have asymmetric effects on income inequality and unemployment across countries.

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1 Introduction

The last decade has witnessed substantial changes in the U.S. distribution of earnings. According to Haskel et al. (2012), since 2000 real earnings of most U.S. workers have declined independently of educational status, and corporate profits have increased substantially reaching 12.4 percent of GDP in 2010 (the highest percentage in the past 60 years). In addition, the share of U.S. income accounted by the top 1 percent earners rose steadily from 13.5 percent in 1995 to 16.5 in 2000, reaching 18.3 percent in 2007. During the same period, the process of globalization steadily intensified caused by further improvements in communication and transportation technology leading to reductions in trade barriers and a surge in trade. The 2007 financial crises added two features to this process: persistent high unemployment in advanced countries, and significant changes in volume and terms of trade among many countries. U.S. aggregate unemployment rate has stayed above 8 percent in the past five years, and Europe has experienced double digit unemployment rates with unemployment reaching over 25 percent in countries such as Greece and Spain. In addition, Gopinath et al. (2012) documented that the global trade collapse of 2008-2009 lead to significant changes in trade prices and volume across countries.

These developments have generated renewed interest among economists in the nexus among unemployment, personal income distribution, and globalization. This interest is guided by some of the following questions. Is more trade job-creating or job-destroying? What are the effects of international competitiveness captured by better terms of trade on personal income distribution, unemployment, and welfare? What is the relationship between comparative advantage and labor market frictions in a global economy with persistent unemployment? Can one identify the nature and effects of economic recovery policies? Do unilateral job-creating policies have any adverse effects on other countries?

In this paper, we propose a simple theory of personal income distribution, equilibrium unemployment, and trade addressing these questions. Labor is the only factor of production and consists of a fixed measure of individuals differing in managerial talent (ability). The economy produces two goods, a traditional and a modern one, under perfect competition. The traditional sector consists of a measure of single-worker firms, whereas the modern sector consists of multiple-worker firms managed by self-employed entrepreneurs with high managerial talent as in Lucas (1978).[1] Individuals with low managerial talent choose to become workers. An entrepreneur may enhance the productivity of her firm by acquiring managerial capital which depends positively on managerial talent. In contrast, worker productivity is independent of ability. We assume, for tractability purposes, that entrepreneurs do not face the prospect of unemployment and their earnings equal firm profits, whereas workers have to search for jobs. Labor markets for workers exhibit search frictions leading to equilibrium unemployment.[2]

Having developed a tractable model, we first study a small open jobless economy trading with the rest of the world at fixed terms of trade. An increase in the relative price of modern good leads to a movement of resources from the traditional to the modern good. The effects on aggregate unemployment depend on sector specific differences in labor market distortions. Where the derived parameter measuring the job-finding rate is higher in the modern sector than in the traditional sector, then an increase in the price of the modern good reduces aggregate unemployment. The opposite occurs if the job-finding rate in the traditional sector is higher. An increase in the the relative price of the modern sector raises the economy's aggregate expenditure, increases income inequality between employed workers and entrepreneurs, and has an ambiguous effect on aggregate welfare.

Next we illustrate the usefulness of the small open economy framework by highlighting a few novel comparative statics properties. We employ the assumption that the job-finding

[1] As in Lucas (1998), Monte (2011) studies the impact of skill-biased technical change and trade on wage inequality when individuals endogenously choose to become workers or managers. He assumes perfectly competitive labor markets leading to full employment and abstracts from managerial capital acquisition. Sampson (2012) also studies the effect of trade on wage inequality by incorporating worker heterogeneity into Melitz's (2003) model of intraindustry trade with heterogeneous firms. His model predicts a positive assortative matching between worker skill and firm technology such that intraindustry trade raises wage inequality in all countries. However, he abstracts from unemployment considerations and job-creating policies.

[2] Botero et al. (2004) among others document the prevalence of labor market frictions stemming primarily from national labor regulation policies. These policies different across countries, affect adversely labor force participation, and contribute to unemployment especially among young workers.

rate in the modern sector is higher than the corresponding one in the traditional sector, and analyze the effects of international competitiveness measured by the absolute difference between the economy's terms of trade (relative price of its exportable) and the autarky price. Within the context of our static model, greater international competitiveness can occur in two ways: through an exogenous improvement in the terms of trade caused by lower trade costs or the global financial crises; or product market policies that change the domestic price such as tariffs and/or export subsidies. Under parameter assumptions implying lower labor-market distortions in the modern sector, the effects of international competitiveness depend on the initial trade pattern. Improvements in international competitiveness raise the possibility of immiserizing (lower welfare), jobless (higher unemployment), and unfair (worse income distribution) recoveries with higher GDP.

We then discuss the effects of two job-creating labor-market policies within the context of a small open jobless economy. Policies generating lower costs of managerial capital or policies generating lower costs of posting job-vacancies in the modern sector have identical effects. They lead to lower unemployment, higher GDP, and higher welfare. As such, they are preferable to product market policies that might lead to a recession. These results are consistent with the generalized theory of distortions and welfare.

Finally, we extend our analysis to a two-country framework to study the determinants of comparative advantage, trade liberalization, and unilateral job-creating policies. A country exports the modern good if it has lower costs of managerial capital and a relatively lower labor-market frictions in modern sector. A move from autarky to free trade has asymmetric effects on income inequality and the rate of unemployment across two countries. Although free trade has an ambiguous welfare effect on Home (assuming that Home exports the modern good), it improves welfare in Foreign. Furthermore, our analysis show that a *unilateral* job-creating policy also has asymmetric effects on income inequality and unemployment across countries. This policy has an ambiguous effect on the welfare in the country that implements it, while improving the welfare in the partner country.

This paper is related to a growing literature investigating the nexus between trade and unemployment. Researchers in this literature have identified different sources of labor market frictions that lead to equilibrium unemployment. In Brecher (1974) and Egger et al. (2012), for example, unemployment stems from minimum wages, whereas in Copeland's (1989) and Davis and Harrigan's (2011) models efficiency wages play key role in generating equilibrium unemployment. In Kreickemeier and Nelson (2006), Amiti and Davis (2011), and Egger and Kreickemeier (2009) unemployment stems from implementation of fair wages.

Our model is more closely related to the trade literature that uses standard Diamond–Mortensen–Pissarides search and matching frictions in the labor markets as a source of unemployment.[3] In an important contribution, Davidson et al. (1999) developed a general equilibrium search model of trade between two countries to investigate the robustness of main results obtained in traditional, full-employment trade models.[4] In their model, both sectors share the same production technology which is also common across countries. However, differences in job turnover rates across sectors and countries determine the pattern of trade. Although there are workers and entrepreneurs in their model, their supplies are exogenously given. In addition, their model assumes away managerial capital acquisition, and thus trade does not affect firm productivity.[5]

Helpman and Itskhoki (2010) introduce search and matching frictions leading to equilibrium unemployment in a trade model with product differentiation, monopolistic competition, and scale economies.[6] Helpman et al. (2010) extends Helpman and Itskhoki (2010)

[3]Helpman et al. (2011) provides a comprehensive review of this literature by emphasizing the role of firm heterogeneity.

[4]Davidson et al. (1999) build on Davidson et al. (1998) that study two-sector, closed-economy, general equilibrium models with frictional unemployment. Davidson and Matusz (2010) provides several extensions of the Davidson et al. (1999) model to study how international trade affects labor markets and how structural differences in labor markets affect international trade.

[5]Dutt et al. (2009) develop a model with search and matching frictions leading to unemployment. In their model, trade results from either Heckscher-Ohlin or Ricardian comparative advantage, whereas in the present model the pattern of trade depends on relative costs of managerial capital acquisition and relative labor market frictions.

[6]See also Felbermayr et al. (2011) who use a similar set-up to study the relationship between trade and unemployment in a context of symmetric countries.

by introducing match-specific heterogeneity in ability across workers to study the impact of trade on wage distribution. Imperfectly competitive product markets complicate their analysis, and necessitate the use of a two-country framework because firms in these models are not price takers. In addition, they do not consider the effects of self-employed entrepreneurs by assuming that the supply of workers is exogenous. Our theory makes possible the study labor-market frictions and trade without additional complications and distortions stemming from product market imperfections, and also allows us to analyze the effects of international trade and policies in the context of a small open jobless economy. Moreover, our theory complements Helpman et al. (2010) by highlighting the nature of income inequality fueled by firm profits stemming from heterogeneous entrepreneurial talent (as opposed to income inequality based on differences in wages generated by heterogeneous worker ability).[7]

The rest of the paper is organized as follows. Section 2 describes the model. Section 3 introduces international trade considerations by analyzing the properties of a small, open, jobless economy and a two-country global economy. Section 4 concludes.

2 The Model

Consider an economy producing two homogeneous goods indexed by $i = 1, 2$. The economy is populated by a unit mass of identical families. Each family supplies labor consisting of all family members and has size equal to one as well. Family members possess different ability levels indexed by a. In the present context, *ability* is a broad generic term measuring managerial talent, level of training or education and any other attribute helping an individual to acquire managerial (entrepreneurial) capital. The distribution of abilities is given by an exogenous cumulative distribution $G(a)$ with density $g(a)$ and support $[1, \infty)$.

Decisions are made sequentially. An individual first decides whether to become an entrepreneur or a worker. An entrepreneur with a given entrepreneurial talent chooses the

[7] Welfare implications of our model are also different from these seminal contributions. Although exposure to trade is always welfare improving in Helpman and Itskhoki (2010) and Helpman et al. (2010), it can be welfare reducing in our model as Section 3 demonstrates.

optimal level of managerial capital, followed by how many workers to employ. The latter choice is conditioned by the presence of hiring costs stemming from search-related frictions. Each entrepreneur bargains with hired workers to determine the negotiated wage while treating the level of managerial capital and hiring costs as sunk. Entrepreneurial income equals firm profits. Each worker decides first in which sector to search for a job based on wage and unemployment considerations. Once committed, a worker cannot switch sectors. Finally, each family engages in appropriate income transfers among its members equalizing their income and utility levels independently of employment statue and managerial talent (ability). Accordingly, aggregate welfare equals the sum of individual utilities across all family members.

2.1 Preferences

Family members have identical preferences over the two homogeneous goods as described by the following utility function

$$u = \left(\frac{q_1}{1-\beta}\right)^{1-\beta} \left(\frac{q_2}{\beta}\right)^{\beta}, \tag{1}$$

where q_i is consumption of good $i = 1, 2$, and $0 < \beta < 1$ is an exogenous, constant parameter.

Denoting with e individual income (expenditure), one can express the demand for good i as

$$q_i = \beta_i e / p_i, \tag{2}$$

where $\beta_1 = 1 - \beta$, $\beta_2 = \beta$, and p_i is the price of good i. We choose good 1 as the numeraire by setting its price equal to one (i.e., $p_1 = 1$). To further simplify notation, we rewrite the relative price of good 2 as p.

Substituting q_i from (2) into (1) yields the indirect utility

$$\mathrm{v}(e, p) = e p^{-\beta}, \tag{3}$$

which increases with income e and decreases with the relative price of good 2, p (i.e., p^{β} is the price index expressed in units of good 2). The linear dependence of indirect utility on income indicates that individuals are risk neutral.[8]

2.2 Production and Job Creation

We refer to good 1 as the traditional good and to good 2 as the modern good. Production of traditional good 1 is carried out by small, identical, and single-worker firms. The concept of single-worker firms has been used extensively in the Diamond-Mortensen-Pissarides (DMP) literature of equilibrium search unemployment (e.g., Chapter 1 in Pissarides, 2004). Each firm posts a job vacancy and hires one worker, but vacancies are not instantaneously filled due to of matching and search frictions. When a firm hires a worker, the worker produces one unit of good 1 independently of ability. Upon matching, the firm and worker bargain over revenue earned by selling one unit of output at $p_1 = 1$. Assuming equal bargaining power and zero value of outside options (e.g., no unemployment insurance), the worker receives $\mathrm{w}_1 = 1/2$.

Good 2 is produced by a continuum of heterogeneous firms, each owned and managed by an entrepreneur. The production technology of sector 2 has two features: heterogeneous managerial (or organization) capital denoted by z; and diminishing returns with respect to managerial capital capturing "span of control" as in Lucas (1978). The production function of a firm managed by an entrepreneur with managerial capital z is given by

$$y_2(z) = \left(\frac{z}{1-\eta}\right)^{1-\eta} \left(\frac{l}{\eta}\right)^{\eta}, \tag{4}$$

where l is the number of workers employed and $\eta \in (0, 1)$ is an exogenous parameter.

According to (4), organizational capital z also represents firm productivity and exhibits diminishing returns for any given level of labor l. Thus, we hereafter use the terms manage-

[8]Risk aversion considerations can be readily introduced into the analysis by assuming that utility takes the form $u = (q_1/\beta_1)^{\beta_1}(q_2/\beta_2)^{\beta_2}$, with $\beta_1 + \beta_2 < 1$ such that the indirect utility is concave in income. However, we confine ourselves to the risk-neutral case to simplify the subsequent exposition and enhance the intuition.

rial capital and firm productivity interchangeably. The above formulation delivers a market structure with heterogeneous firms producing a homogeneous product under perfect competition. Heterogeneous firm productivity stems from endogenous formation of organizational capital which is based on an exogenous distribution of managerial talent. As a result, this paper complements seminal studies of firm heterogeneity, such as Hopenhayn (1992) and Melitz (2003). These studies postulate an exogenous (as opposed to an endogenous) distribution of firm productivity.

Following the insights of human capital theory, we assume that individuals choose to become entrepreneurs or workers depending on income considerations and costs of acquiring managerial capital. In particular, we postulate that an individual with ability (managerial talent) a faces $\lambda z^2/2a$ costs of acquiring z units of managerial capital, where $\lambda > 0$ is an exogenous parameter. The costs of acquiring managerial capital are measured in units of good 1, decline with the level of ability, and increase with the level of managerial capital. The proposed cost function captures, albeit in a reduced form, the idea that human capital formation is costly involving various inputs, experience, schooling, on-the-job training, etc. These dynamic elements are not explicitly modeled but captured by shift parameter λ. This quadratic cost function delivers linear marginal costs and leads to an interior, closed-from solution. Higher values of λ are associated with higher total and marginal costs of managerial-capital acquisition. In what follows, we will refer to an increase in λ as a rise in costs of acquiring managerial capital.[9]

An entrepreneur with managerial talent a maximizes her earnings $e_2(a)$, equal to firm profits, by choosing the level of managerial capital z and the number of employees l. As in the traditional sector 1, hiring in the modern sector is costly due to search and matching frictions. A firm with productivity z may hire l workers instantaneously by incurring hiring cost $c_2 l$, measured in terms of good 1. In addition, the firm incurs a wage bill denoted by $\mathrm{w}_2 l$, where w_2 is the negotiated wage between the entrepreneur and employees, as will

[9]The production-function based approach to human capital formation has long tradition going back to seminal studies by Becker (1994) and Ben-Porath (1967) among many others.

be shown below. As a result, an entrepreneur incurs managerial capital costs and two types of labor costs: hiring costs and the wage bill. As will be discussed in the next section, hiring-cost parameter c_2 depends on sector-specific labor market conditions, and therefore is common across all firms producing good 2. This discussion leads to the following expression for entrepreneurial income

$$e_2(a) \equiv \max \left\{ p y_2(z) - \mathrm{w}_2 l - c_2 l - \frac{\lambda z^2}{2a} \right\}, \tag{5}$$

where $y_2(z)$ is given by (4).

Next we describe the determination of the negotiated wage rate w_2 and labor input l recognizing that wage bargaining occurs after the processes of hiring and managerial-capital acquisition. Specifically, upon a match an employee cannot be replaced without cost, and thus a hired worker is not interchangeable with an outside worker. Consequently, hired workers have bargaining power. The wage bargaining process is modeled as in Stole and Zwiebel (1996a): the firm engages in bilateral bargaining with each worker and internalizes the effect of a worker's departure on wages of remaining workers. In our model all workers are identical in regards to output productivity, since the latter is independent of ability by assumption.[10] As a result, a firm treats each worker as marginal; and firm surplus from a worker departure equals the marginal change in firm value (profits) with respect to labor. We assume that the value of outside options for each party is zero (hence, workers do not receive unemployment benefits); and therefore worker surplus equals the negotiated wage. Assuming equal bargaining power, the Stole and Zwiebel (1996a) solution requires that total surplus be equally split between the entrepreneur and a worker according to

$$\frac{\partial}{\partial l}[p y_2(z) - \mathrm{w}_2 l] = \mathrm{w}_2,$$

where w_2 is the negotiated wage rate and p is the relative price of good 2.[11] Because hiring

[10] Helpman et al. (2010) develop a model of unemployment and inequality where worker productivity depends on ability and firms engage in ex-ante screening for worker ability. Screening leads to more productive firms offering higher wages. Our model complements their analysis by focusing on endogenous firm productivity (based on managerial capital acquisition) and equally productive workers.

[11] Incorporating asymmetric bargaining power between an entrepreneur and workers as in Stole and Zwiebel (1996b) does not alter the main results.

costs $c_2 l$ and managerial-capital acquisition costs $\lambda z^2/2a$ are sunk (i.e., they are paid before the bargaining process), these terms do not appear in the right hand side. The solution to this ordinary differential equation provides the following expression for the negotiated wage

$$\mathrm{w}_2 = \frac{p}{1+\eta}\left[\frac{\eta z}{(1-\eta)l}\right]^{1-\eta}. \tag{6}$$

According to (6), the negotiated wage increases with price p and firm productivity z, and decreases with firm size measured by the number of employees l.[12]

Faced with the negotiated wage rate, an entrepreneur chooses the number of employees l by taking into account hiring costs to maximize (5). This maximization yields

$$\mathrm{w}_2 = \frac{p}{1+\eta}\left[\frac{\eta z}{(1-\eta)l}\right]^{1-\eta} = c_2. \tag{7}$$

Consequently all entrepreneurs (irrespective of managerial capital and firm size) pay the same wage to workers, that is $\mathrm{w}_2 = c_2$. The above equation can be solved for the number of workers hired by a firm with productivity z

$$l = \frac{\eta}{1-\eta}\left[\frac{p}{(1+\eta)c_2}\right]^{\frac{1}{1-\eta}} z. \tag{8}$$

Equation (8) is the firm demand for labor in the presence of labor market frictions. This demand for hired labor (l) declines with the level of hiring costs per worker (c_2), and increases with the relative price of good 2 (p) and firm productivity (z). Thus, firms with higher productivity and lower hiring costs per employee employ more workers.

2.3 Talent Allocation

An entrepreneur with managerial talent a maximizes earnings (economic profits) by choosing the level of managerial capital z after taking into account labor costs. Substituting $\mathrm{w}_2 = c_2$ from (7) and (8) into equation (5), and maximizing the resulting function with respect to z yields

$$z = \frac{a}{\lambda}\left[\frac{p}{(1+\eta)c_2^{\eta}}\right]^{\frac{1}{1-\eta}}. \tag{9}$$

[12] It can easily be verified that (6) is the solution to the differential equation by substituting (6) in the former and performing the calculations.

Equation (9) indicates that the optimal level of acquired managerial capital increases with managerial talent a and price p; and decreases with hiring cost per worker c_2, and the costs of managerial capital λ.

The choice of becoming an entrepreneur or a worker is affected by expected income considerations. Substituting $\mathrm{w}_2 = c_2$ from (7), l from (8), and z from (9) into equation (5) provides a closed-form expression for maximum income $e_2(a)$ earned by an active entrepreneur

$$e_2(a) = \frac{a}{2\lambda} \left[\frac{p}{(1+\eta)c_2^{\eta}} \right]^{\frac{2}{1-\eta}} . \tag{10}$$

The return on entrepreneurship $e_2(a)$ is an increasing linear function of managerial talent a and behaves similarly to the optimal level of managerial capital z: it increases with relative price p, and declines with the costs of managerial capital acquisition λ and hiring c_2.

Active entrepreneurs do not face the prospect of unemployment and receive $e_2(a)$ with certainty. The next section will formally establish that, since individuals are risk neutral, ex-ante worker income is equalized across sectors, that is, all workers receive the same expected wage. Worker income is independent of managerial talent a by assumption, and entrepreneurial income increases linearly with the level of managerial talent, as indicated by (10). As a result, there exists a unique cutoff level of managerial talent $a^* > 0$ such that all individuals with talent $a < a^*$ choose to become workers, whereas all individuals with talent $a \geqslant a^*$ choose to become self-employed entrepreneurs.

Deriving an explicit expression for the cutoff level of managerial talent requires determination of expected worker income in one of the two sectors. It is simpler and more convenient to focus on the traditional sector, where worker income is $e_1 = \mathrm{w}_1 = 1/2$. Let ζ_1 denote the job-finding probability in sector 1 (to be determined in the next section). Expected worker income then is simply $\mathbb{E}[e_1] = \zeta_1 \mathrm{w}_1 = \zeta_1/2$.

An individual chooses to become an entrepreneur if and only if $e_2(a) \geqslant \mathbb{E}[e_1]$. The cutoff level of managerial talent a^*, at which an individual is indifferent between becoming an entrepreneur or a worker, is given by $e_2(a^*) = \zeta_1/2$.Using (10) yields

$$a^* = \lambda\zeta_1 \left[\frac{(1+\eta)c_2^\eta}{p}\right]^{\frac{2}{1-\eta}}. \tag{11}$$

As in Lucas (1978), only the most talented individuals become entrepreneurs. However, unlike Lucas (1978), in the present model entrepreneurs acquire managerial capital and workers face the threat of unemployment. The cutoff level of managerial talent a^* is endogenous and increases with per-worker hiring cost c_2, the probability of finding a job as a worker ζ_1 (constituting a component of opportunity costs of entrepreneurship), and costs of managerial capital λ. The cutoff level of managerial talent decreases with relative price p, as expected.

Finally, combining equations (9) and (11) yields

$$z = \left(\frac{\zeta_1}{\lambda a^*}\right)^{\frac{1}{2}} a, \tag{12}$$

stating that the optimal level of managerial capital increases with the probability of finding a job in the traditional sector ζ_1, and decreases with the talent cutoff level a^* and costs of acquiring managerial capital λ.

2.4 Equilibrium Unemployment

Workers are risk neutral and decide whether to search for a job in the traditional or modern sectors. The labor market exhibit search frictions as in the standard DMP theory of unemployment. As indicated previously, we assume that once committed to a sector a worker cannot move to another sector, i.e. there is no ex-post inter-sectoral worker mobility.

Let N_i and V_i denote the number of unemployed workers searching for jobs and total number of posted job vacancies in sector $i = 1, 2$. We assume that the number of successful matches (e.g., hired workers) in sector i is given by Cobb-Douglas matching function $M_i = m_i V_i^\xi N_i^{1-\xi}$, where parameter m_i measures matching efficiency, and $\xi \in (0, 1)$ is a constant parameter. Assuming that $M_i < N_i$, the job finding rate $\zeta_i \equiv M_i/N_i$, interpreted as the probability that an unemployed worker matches with a firm is given by $\zeta_i = m_i(V_i/N_i)^{\xi} < 1$, where V_i/N_i is the number or vacancies per unemployed worker. The term ζ_i is an index of labor-market tightness and captures the notion that a higher job-finding rate implies a greater number of vacant jobs per unemployed worker, that is more firms are posting vacancies and therefore there is higher excess demand for labor (leading to a tighter labor market). Consequently, in what follows we use the terms job-finding rate and labor-market tightness interchangeably.

Following Blanchard and Gali (2010), we assume that a firm can hire workers instantaneously by incurring a cost of hiring one worker expressed in units of the traditional good. Hiring cost per worker in sector i is given by

$$c_i(\zeta_i) = \tau_i \zeta_i^{\gamma}, \tag{13}$$

where the exogenous parameter τ_i is an index of labor market frictions; ζ_i is the job-finding rate or the labor market tightness index; and $\gamma > 0$ is a constant parameter. According to equation (13), higher market tightness ζ_i implies greater instantaneous hiring costs per worker c_i, for any given degree of labor market frictions τ_i. As shown by Blanchard and Gali (2010, footnote 6), the above hiring cost function can be derived from a standard constant returns to scale Cobb-Douglas matching function. Accordingly, where the matching function is given by $M_i = m_i V_i^{\xi} N_i^{1-\xi}$, the two parameters in (13) are given by $\gamma = (1-\xi)/\xi > 0$ and $\tau_i = m_i^{-1/\xi}$. As a result, τ_i declines with matching efficiency m_i, and therefore corresponds to an index of labor-market frictions (rigidities) in sector i.

Consider next sector 1 where each firm employs one worker. Entry to the market is unrestricted, but each firm faces entry costs equal to the cost of posting a vacancy (denoted by ν_1 and measured in units of good 1). It then follows that $\chi_1 = \nu_1/c_1$ represents the probability that a firm fills a vacancy, that is χ_1 is the hiring rate in the traditional sector. Because each firm receives half of generated revenue, expected profit is $\chi_1/2$. As a result, free-entry condition $\chi_1/2 = \nu_1$ implies $c_1 = 1/2$. Substituting $c_1 = 1/2$ into (13) yields the following equilibrium values for the job-finding rate and hiring costs in sector 1:

$$\zeta_1 = (2\tau_1)^{-\frac{1}{\gamma}}, \qquad c_1 = \frac{1}{2}. \tag{14}$$

We assume that $\tau_1 < 1/2$ to ensure that the job-finding rate ζ_1 is smaller than one. Note that the equilibrium probability of finding a job in this sector decreases with the degree of labor market frictions τ_1, as expected. Accordingly, greater labor-market frictions lead to lower labor-market tightness in sector 1. In the traditional sector, hiring cost per employee c_1 and labor-market tightness ζ_1 are exogenously determined by labor-market (as opposed to product-market) parameters.

Next we address the determination of job-finding rate ζ_2 and hiring-cost per employee c_2. Ex-ante labor mobility across sectors implies that a worker must be indifferent between assigned to the traditional or modern sectors. Because workers are risk-neutral, equilibrium in the labor market requires equalization of expected worker earnings between sectors. Expected earnings of a worker searching for a job in sector 1 is simply $\zeta_1/2$, and expected earnings of a worker searching for a job in sector 2 is $\zeta_2 \mathrm{w}_2 = \zeta_2 c_2$. Using equations (13) and (14), $\zeta_1/2 = \zeta_2 c_2$ yields the following expressions for the job-finding rate and hiring costs in sector 2:

$$\zeta_2 = 2^{-\frac{1}{\gamma}} \tau_1^{-\frac{1}{\gamma(1+\gamma)}} \tau_2^{-\frac{1}{1+\gamma}}, \qquad c_2 = \frac{1}{2}\left(\frac{\tau_2}{\tau_1}\right)^{\frac{1}{1+\gamma}}. \tag{15}$$

To determine the unemployment rate among workers, first observe that the measure of individuals who decide to enter the labor force as workers is $G(a^*)$ since the size of population is normalized to unity. Observe also that $\zeta_2 N_2 = \int_{a^*}^{\infty} l g(a) da$, where l is given by (8). Using (9) together with (11) in the integration yields the measure of workers assigned to sector 2

$$N_2 = \frac{2\eta}{(1-\eta)} \frac{\mathbb{E}[a \geqslant a^*]}{a^*}, \tag{16}$$

where $\mathbb{E}[a \geqslant a^*] = \int_{a^*}^{\infty} a g(a) da$ is the expected level of entrepreneurial talent in sector 2. The aggregate unemployment rate among workers is defined as the measure of unemployed workers in both sectors divided by the aggregate measure of workers searching for jobs. The measure of unemployed workers in sector i is $U_i = (1-\zeta_i)N_i$, and the aggregate measure of workers searching for a job is equal to the supply of workers $G(a^*) = N_1 + N_2$, because entrepreneurs are fully employed. As a result, the economy-wide unemployment rate is given by $\mathcal{U} = (U_1 + U_2)/G(a^*)$ and can be written as

$$\mathcal{U} = (1-\zeta_1) + (\zeta_1 - \zeta_2)\frac{N_2}{G(a^*)} = (1-\zeta_1) + (\zeta_1 - \zeta_2)\frac{2\eta}{(1-\eta)}\frac{\mathbb{E}[a \geqslant a^*]}{a^* G(a^*)}, \tag{17}$$

where job-finding rates ζ_1 and ζ_2 are given by (14) and (15), and $N_2/G(a^*) < 1$ is the fraction of workers assigned to the modern sector. In Helpman and Itskhoki (2010), the supply of workers is exogenous, and as a result, aggregate unemployment is affected only through changes in N_2. In contrast, in the present model self-employed entrepreneurs influence worker supply $G(a^*)$. The latter is endogenous and affects the level and behavior of aggregate unemployment rate.

2.5 Aggregation

Armed with these variables, we can determine total revenue in each sector

$$Y_1 = \zeta_1 N_1 = \zeta_1 \left[G(a^*) - \frac{2\eta}{(1-\eta)}\frac{\mathbb{E}[a \geqslant a^*]}{a^*} \right], \tag{18a}$$

$$pY_2 = \int_{a^*}^{\infty} p y_2(a) g(a) da = \frac{(1+\eta)\zeta_1}{(1-\eta)}\frac{\mathbb{E}[a \geqslant a^*]}{a^*}, \tag{18b}$$

where ζ_1 is given by (14).[13]

Aggregate hiring costs in each sector are given by

$$\begin{aligned} C_{1h} &= c_1 \zeta_1 N_1 = \frac{\zeta_1}{2}\left[G(a^*) - \frac{2\eta}{(1-\eta)}\frac{\mathbb{E}[a \geqslant a^*]}{a^*} \right], \\ C_{2h} &= \int_{a^*}^{\infty} c_2 l(a) g(a) da = \frac{\eta \zeta_1}{1-\eta}\frac{\mathbb{E}[a \geqslant a^*]}{a^*}. \end{aligned}$$

Traditional good 1 is also used in formation of managerial capital. Because each entrepreneur uses $\lambda z^2/2a$ units of good 1, equation (12) implies that $z^2/2a = \zeta_1 a/(2a^*)$.

[13] Equation (7) implies that $py_2(z) = (1+\eta)c_2 l/\eta$ and equations (8), (9), and (11) imply that $c_2 l = \eta\zeta_1 a/[(1-\eta)a^*]$. Thus, $py_2(a) = (1+\eta)\zeta_1 a/[(1-\eta)a^*]$, and integrating this last expression across all entrepreneurs yields (18b).

Integrating this expression across all entrepreneurs yields the aggregate level of resources, expressed in units of good 1, allocated in the formation of managerial capital, C_z,

$$C_z = \frac{\zeta_1}{2} \frac{\mathbb{E}[a \geqslant a^*]}{a^*}. \tag{19}$$

Thus total amount of resources used in hiring and the formation of organizational capital is given by

$$C = C_{1h} + C_{2h} + C_z = \frac{\zeta_1}{2} \left[G(a^*) + \frac{\mathbb{E}[a \geqslant a^*]}{a^*} \right]. \tag{20}$$

2.6 Income Distribution and Welfare

Equations (10) and (11) imply that the income of an entrepreneur with ability a is given by $e_2(a) = \zeta_1 a/(2a^*)$. Worker income in sector 1 is $\mathrm{w}_1 = 1/2$ and worker income in sector 2 is $\mathrm{w}_2 = c_2$. As a result, ex-post personal income distribution is given by

$$e(a) = \begin{cases} 0 & \text{if } a < a^* \text{ and worker is unemployed} \\ 1/2 & \text{if } a < a^* \text{ and worker is employed in sector 1} \\ c_2 & \text{if } a < a^* \text{ and worker is employed in sector 2} \\ \zeta_1 a/(2a^*) & \text{if } a \geqslant a^* \text{ and individual is self-employed entrepreneur} \end{cases} \tag{21}$$

where ζ_1 and c_2 are given by (14) and (15), respectively. Because ζ_i is the probability of finding a job in sector i, it follows from the law of large numbers that $\zeta_i N_i$ is the number of workers and $\mathrm{w}_i \zeta_i N_i$ is the total wage paid the workers in sector i. Using the above income distribution,and the assumption that agents are risk-neutral (i.e., $\zeta_1/2 = \zeta_2 c_2$), leads to the following expression for aggregate income

$$E = \frac{\zeta_1}{2} \left[G(a^*) + \frac{\mathbb{E}[a \geqslant a^*]}{a^*} \right]. \tag{22}$$

Comparing (22) to (20) reveals that $E = Y_1 + pY_2 - C$ and $E = C = (Y_1 + pY_2)/2$, i.e. half of the economy's GDP covers hiring and managerial capital costs and half of GDP covers earnings of workers and entrepreneurs.

For future purposes it is useful to highlight several properties of aggregate expenditure E. The expression in square brackets in (22) depends only on the distribution of managerial talent and its cutoff level a^*. Furthermore, irrespectively of the distribution of managerial talent, aggregate expenditure E is a decreasing, convex function of a^*.[14] Higher cutoff level of managerial talent increases aggregate wage income and reduces aggregate entrepreneurial income. The latter affect dominates, since entrepreneurs receive higher income than workers. Convexity is related to the property that income of an inframarginal entrepreneur with managerial talent a is a convex function of cutoff managerial level a^*. Equation (11) implies that the cutoff level of managerial talent a^* is a decreasing , convex function of p.It then follows that aggregate expenditure is an increasing, convex function of p, i.e., $dE/dp > 0$ and $d^2E/dp^2 > 0$.

Lemma 1. *Aggregate expenditure E is a convex, decreasing function of cutoff level of managerial talent a^*; and a convex, increasing function of relative price p.*

Using (3) and (21), one can readily determine the welfare of each individual. However, to address the impact of trade on welfare, we need to aggregate welfare across all individuals. The assumption of identical families allows us to treat aggregate welfare as each family's welfare which equals the sum of the individual utilities. Integrating the resulting indirect utility functions across all individuals within a family leads to the following expression for aggregate welfare

$$\mathbb{V} = Ep^{-\beta}, \tag{23}$$

where E is aggregate expenditure, given by (22).

For future purposes, it is instructive to analyze the dependence of aggregate welfare on the relative price p. An increase in p raises the price index p^β and reduces aggregate welfare $\mathbb{V}$ directly for any given level of expenditure. Differentiating (23) with respect to p, using (22) and $da^*/dp = -(1-\eta)p/(2a^*) < 0$ from equation (11), leads to

$$\frac{d\mathbb{V}}{dp} = \frac{\beta\zeta_1 p^{-(1+\beta)}}{dp}\left[\left(\frac{2-\beta(1-\beta)}{\beta(1-\eta)}\right)\frac{\mathbb{E}[a \geqslant a^*]}{a^*} - G(a^*)\right], \tag{24}$$

[14] Differentiating (22) leads to $\frac{dE}{da^*} = -\frac{\zeta_1}{2}\frac{\mathbb{E}[a \geqslant a^*]}{a^{*2}} < 0$ and $\frac{d^2E}{da^*2} = \frac{\zeta_1 g(a^*)}{2a^*} + \frac{\zeta_1 \mathbb{E}[a \geqslant a^*]}{a^{*3}} > 0$.

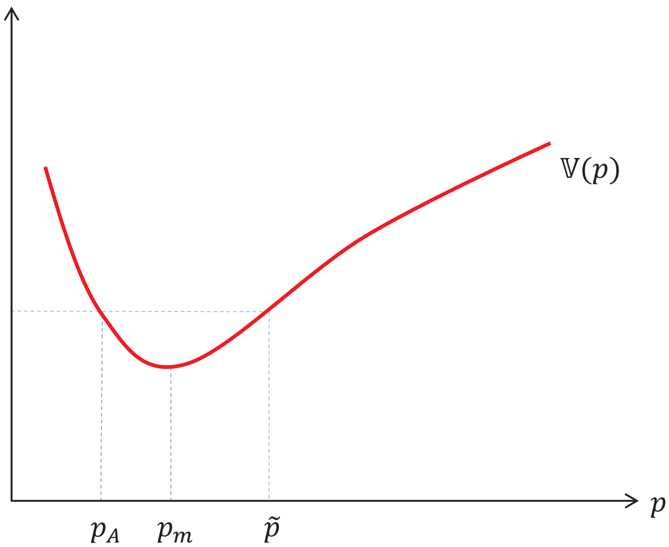

Figure 1: The welfare function

where $a^*$is a decreasing function of p. Where p is small (and therefore a^* is large), the term in brackets is negative; where p is large (and therefore a^* is small), the term in brackets is positive. Thus, aggregate welfare is a U-shape function of the relative price of good 2 as shown in Figure 1.[15] Variable p_A in Figure 1 denotes the autarkic price of good 2, and, as shall be shown shortly, it is less than p_m. In addition, the shape of the welfare function ensures that there exists a relative price of good 2, $\tilde{p}$, such that

$$\mathbb{V}(\tilde{p}) = \mathbb{V}(p_A) \qquad \text{and} \qquad p_A < p_m < \tilde{p}. \tag{25}$$

Setting equation (24) equal to zero leads to the following expression for the minimum-welfare price p_m :

$$\frac{\mathbb{E}[a \geqslant a_m^*]}{a_m^*} = B_m G(a_m^*), \qquad B_m \equiv \frac{\beta(1-\eta)}{2-\beta(1-\eta)}, \tag{26}$$

where a_m^* is the minimum-welfare cutoff level of managerial talent.

[15]If we further assume that the distribution of managerial talent is Pareto such that $G(a) = 1 - a^{-k}$ where $k > 1$ is a shape parameter, then aggregate welfare is a convex U-shape function of p. Under Pareto distribution, we have $E = (\zeta_1/2)[1 + p^{2k/(1-\eta)}/\varepsilon]$ where $\varepsilon \equiv (k-1)(\lambda\zeta_1)^k[(1+\eta)c_2^\eta]^{2k/(1-\eta)}$; and $\mathbb{V} = (\zeta_1/2)[p^{-\beta} + p^{2k/(1-\eta)}/\varepsilon]$, which is a U-shape, convex function of p.

Lemma 2. *Aggregate welfare is a U-shape function of relative price p, and attains its minimum at the cutoff managerial talent level a_m^* given by (26).*

2.7 Closed-Economy Equilibrium

In the closed-economy equilibrium, $Q_1 = Y_1 - C$ and $Q_2 = Y_2$, where Q_i is aggregate quantity consumed of good i. Substituting these expressions into $Q_1/pQ_2 = (1-\beta)/\beta$ from equation (2) implies

$$\frac{\mathbb{E}[a \geqslant a^*]}{a^*} = BG(a^*), \qquad B \equiv \frac{\beta(1-\eta)}{2(1+\eta) - \beta(1-\eta)}. \tag{27}$$

The left hand side (LHS) is a decreasing function of managerial ability cutoff a^*,[16] whereas the right hand side (RHS) is an increasing function of a^*. As a result, equation (27) determines the unique closed-economy equilibrium cutoff level of managerial talent a^*. Because $0 < B < 1$, the equilibrium cutoff level ensures that both goods are produced, i.e. $N_i > 0$ for $i = 1, 2$.[17] Observe that the equilibrium cutoff level of managerial talent a^* does not depend on parameters capturing labor market rigidities such as hiring costs per employee, costs of posting and maintaining job vacancies, and costs of managerial capital. This property facilitates the analysis of comparative advantage in the next section.

Lemma 3. *The closed-economy equilibrium cutoff level of managerial talent a^* satisfying equilibrium condition (27) exists and is unique.*

Once the closed-economy cutoff level of managerial talent is determined, one can easily determine the remaining endogenous variables. First, substituting the cutoff talent level a^* into (21) and (22) pins down the distribution of personal income and aggregate income,

[16] $d\mathbb{E}[a \geqslant a^*]/da^* = d\left[\int_{a^*}^{\infty} ag(a)da\right]/da^* = -a^*g(a^*) < 0$.

[17] Equation (27) can be written as $N_2/G(a^*) = 2\eta\mathbb{E}[a \geqslant a^*]/[(1-\eta)a^*G(a^*)] = 2\eta B/(1-\eta) < 1$ implying that the equilibrium share of workers assigned in sector 2 is strictly positive and strictly less than one. This result combined with the supply of workers $G(a^*) = N_1 + N_2$ implies $N_i > 0$, i.e. the closed-economy equilibrium is characterized by incomplete specialization of production.

respectively. Second, substituting a^* into (12) yields the equilibrium cutoff level of managerial capital $\zeta^* = (a^*\zeta_1/\lambda)^{1/2}$, where ζ_1 is exogenous and given by (14). Third, equations in (15) determine the job-finding rate ζ_2 and hiring cost per worker c_2, respectively. Fourth, substituting c_2 into (11) yields the relative price of good 2, p; and substituting p into (23) determines aggregate welfare.

Using equilibrium condition (27) in (17) provides the following expression for aggregate unemployment rate

$$\mathcal{U} = (1-\zeta_1) + (\zeta_1 - \zeta_2)\frac{2\eta B}{1-\eta},$$

where parameter B is defined in (27) and expression $2\eta B/(1-\eta)$ is the equilibrium share of workers assigned to sector 2. Finally, note that the autarkic relative price of modern good p_A can be written as a function of a^* from (11)

$$p_A = (1+\eta)c_2^{\eta}\left[\frac{\lambda\zeta_1}{a^*}\right]^{\frac{1-\eta}{2}}, \tag{28}$$

where ζ_1 and c_2 are given by (14) and (15). The autarkic price depends on virtually all parameters: it increases with labor-market tightness in the traditional sector and with the cost of managerial capital acquisition; and declines with parameters increasing the cutoff level of managerial talent a^* which is determined by (27).

A comparison of (26) with (27) reveals that $a_m^* < a^*$ because $B_m > B$ for any $0 < \eta < 1$ and $0 < \beta < 1$. This implies that $p_A < p_m$, i.e. aggregate welfare is not minimized at the autarky price. This property has implications for the welfare effects of trade liberalization and deserves a few comments. There are a few distortion-related forces determining the "underproduction" of good 1 at the autarkic equilibrium. Observe that the ranking of these prices depends solely on production parameter η capturing the span of managerial control and taste parameter β capturing the share of income spent on good 2. In the extreme case where $\eta = 0$ implying constant returns to managerial capital, $B_m = B$ and $a_m^* = a^*$. In this case, welfare is minimized at the autarky price. As the degree of diminishing returns in managerial capital rises with an increase in η, the incentive to enter sector 2 and become an entrepreneur diminishes leading to a higher ability cutoff level of managerial talent in autarky (i.e., $a_m^* < a^*$) and requiring a lower relative price of good 2 according to equation (11). Furthermore, since workers face the prospect of unemployment, more individuals would like to become entrepreneurs. Increased competition among individuals to become entrepreneurs induce only more able individuals to be managers.

3 Open Economy

In this section, we extend our framework to analyze the nexus of trade, unemployment, inequality, and welfare. We discuss two cases: first, we employ the framework of a small, open, jobless economy taking its terms of trade (relative price of good 2) as given; and second, we employ a two-country framework to analyze the role of labor market rigidities and costs of managerial capital acquisition as sources of comparative advantage.

3.1 A Small Open Jobless Economy

Consider now a small open economy trading with the rest of the word at a fixed international relative price of good 2 denoted by p_T. Following the standard practice of trade theory, we assume balanced trade:

$$Y_1 - Q_1 - C + p_T(Y_2 - Q_2) = 0,$$

where Y_i is quantity supplied and Q_i is quantity demanded for good i. The balanced trade condition can be written in an equivalent form as $E = Y_1 + p_T Y_2 - C = Q_1 + p_T Q_2$, where aggregate expenditure E is given by (22). In other words, the value of aggregate expenditure (income) equals the value of aggregate production net of hiring and organization capital costs (treated as intermediate inputs).

Substituting the international price p_T into equation (11) provides the equilibrium level of managerial talent

$$a_T^* = \lambda\zeta_1 \left[\frac{(1+\eta)c_2^\eta}{p_T}\right]^{\frac{2}{1-\eta}}. \tag{29}$$

where ζ_1 and c_2 are given by (14) and (15). Once a_T^* is determined, we can readily solve for all endogenous variables as in the closed-economy equilibrium.

If the economy produces both goods, then there must be an upper bound, denoted by $p_T^{\max}$, on the relative price of good 2.[18] The trade pattern depends on several factors that determine the ranking between the closed-economy equilibrium price p_A, which is given by (28), and the (exogenous) international price p_T : where $p_A = p_T$, there is no trade; where $0 < p_T < p_A$, the economy exports the traditional good; and where $p_A < p_T < p_T^{\max}$, the economy exports the modern good.

We now investigate the impact of trade on income distribution, welfare, and unemployment. To simplify the subsequent analysis, we further assume that $p_A < p_T < p_T^{\max}$ so that the economy exports the modern good 2 under free trade. Since an increase in the relative price of good 2 from p_A to p_T lowers the managerial talent cutoff from a^* to a_T^*, a move from autarky to free trade increases the number of entrepreneurs. Furthermore, equation (12) implies that trade increases each entrepreneur's managerial capital z. In sum, trade increases both extensive and intensive margins of managerial capital.

The income distribution equation (21) implies that a decrease in managerial cutoff level from a^* to a_T^* raises only entrepreneurial income leaving worker income unaffected. Thus, trade increases income inequality between entrepreneurs and employed workers. In addition, since aggregate expenditure is inversely related to the managerial cutoff level, trade increases aggregate expenditure E.

Although trade increases the aggregate expenditure E, its impact on the aggregate welfare is ambiguous. As shown in Figure 1, if the price of the modern good 2 p_T is greater

[18]Note that equation (29) states that a_T^* is monotonically decreasing in p_T from infinity to zero. As the relative price of good 2 increases and the cutoff level of managerial talent declines, the modern sector expands because more individuals want to become self-employed entrepreneurs and more workers would like to find employment in the modern sector. This process is reflected in the corresponding increase in the fraction of workers assigned in the modern sector $N_2/G(a_T^*) \leqslant 1$. Note also that $N_2/G(a_T^*) = 2\eta\mathbb{E}[a \geqslant a_T^*]/[(1-\eta)a_T^* G(a_T^*)]$ declines monotonically in a_T^*, and approaches unity for a sufficiently small value $a_T^* = a_{\min}^*$. For example, if the distribution of managerial talent is Pareto $G(a) = 1 - a^{-k}$, where $k > 1$ is the shape parameter, then the share of workers in sector 2 is given by $N_2/G(a^*) = 2\eta k/[(1-\eta)(k-1)(a^{*k} - 1)]$. As a result, $a_{\min}^* = [1 + 2\eta k/(1-\eta)(k-1)]^{1/k} > 1$. Replacing a_T^* in (29) with $a_{\min}^*$ yields $p_T^{\max}$.

than $\tilde{p}$ (i.e., $p_T > \tilde{p}$), trade improves aggregate welfare; if $p_T = \tilde{p}$, trade does not affect the welfare; and if $p_A < p_T < \tilde{p}$, trade reduces welfare.[19]

Equation (17) implies that a move from autarky to free trade increases the share of workers employed in the modern sector and has an ambiguous effect on aggregate unemployment: it increases the rate of aggregate unemployment if and only if the job-finding rate in the traditional sector exceeds the one in the modern sector (i.e., $\zeta_1 > \zeta_2$). In other words, the rate of unemployment increases if labor market frictions in the modern sector are more severe than those in the traditional sector. The following proposition summarizes the effects of trade in a jobless, small, and open economy.

Proposition 1. *Consider a small open economy producing both goods such that the relative price of good 2 in autarky is smaller than the corresponding international price ($p_A < p_T$). Trade liberalization captured by a move from autarky to free-trade*

a. *leads to more entrepreneurs and induces each entrepreneur to acquire more managerial capital;*

b. *increases income inequality between entrepreneurs and employed workers; it also increases aggregate expenditure;*

c. *has ambiguous welfare effects: it reduces welfare if $p_T < \tilde{p}$, and increases welfare if $p_T > \tilde{p}$;*

d. *increases aggregate unemployment rate iff the job-finding rate in the traditional sector is greater than the job-finding rate in the modern sector, i.e.* $\zeta_1 > \zeta_2 > 0$.

The model permits the consideration of a related question. Starting from a free-trade equilibrium, what are the effects of an increase in international price, p_T, on income distribution, unemployment, and welfare? This question is closely related to the effects of

[19] We assume that $p_T > p_A$. On the other hand, if $p_T < p_A$ so that the economy imports the modern good 2, trade is always welfare improving as can be seen in Figure 1.

international competitiveness. In the present context, international competitiveness could be captured by the absolute difference between the terms of trade (i.e., the relative price of the exported good) and autarky price, i.e. $|p_T - p_A|$. Higher divergence between these prices leads to more trade and exports and thus greater access to international markets.[20] Specifically, holding the autarky price constant, what are the effects of changes in international competitiveness causes by improvements in the terms of trade?[21]

In the present model, since we assumed that the economy exports the modern good, an increase in p_T improves the economy's terms and volume of trade. The model predicts the possibility of an immiserizing, jobless recovery caused by an improvement in international competitiveness. Consider, for instance, the case where the initial the final terms of trade are lower than the minimum-welfare price (i.e., $p_A < p_T < p_m$), and the labor market frictions are higher in the modern sector (i.e., $\tau_1 < \tau_2$) leading to a lower job-finding rate (i.e., $\zeta_1 > \zeta_2$).[22] An increase in international competitiveness caused by a further improvement in its terms of trade leads to higher aggregate expenditure (GDP), higher unemployment, lower welfare, and worse personal income distribution.

Proposition 2. *Improvements in international competitiveness caused by favorable changes in the economy's terms of trade may lead to an immiserizing, jobless recovery exhibiting higher aggregate unemployment, higher GDP, lower aggregate welfare, and increased income inequality between entrepreneurs and workers.*

We now consider job-creating labor-market policies by writing equation (29) as

$$a_T^* = b\lambda \tau_1^{-\frac{1}{1-\gamma}-\rho} \tau_2^{\rho} p_T^{-\frac{2}{1-\eta}}, \tag{30}$$

[20]In a dynamic framework allowing current account imbalances, international competitiveness is closely related to foreign market access including ownership of foreign assets.

[21]This comparative static exercise is consistent with differential changes in import and export prices caused by the trade collapse of 2008-2009 as documented by Gopinath et al. (2012). For instance, France experience an increase in the price of non-differentiated imports of 0.5% and a decline in the price of non-differentiated exports of 15.5% resulting in a 15% TOT decline (see Table 5 in their paper). Canada experience a 10% TOT increase Germany a 1% TOT increase, and Italy a 5.8% TOT decline during the same period.

[22]As a result, the traditional sector is job-friendly in the sense that as more individuals move to sector 1, the rate of aggregate unemployment declines.

where $b = 2^{-1/\gamma - 2\eta/(1-\eta)}(1+\eta)^{2/1-\eta} > 0$ and $\rho = 2\eta/(1+\gamma)(1-\eta)$ are policy-invariant, inconsequential parameters. The following discussion focuses on job-creating (as opposed to job-destroying) policies under the assumption that the modern sector is employment oriented, that is $\zeta_2 > \zeta_1$, which is equivalent to a lower labor-market tightness in the modern sector, i.e., $\tau_2 < \tau_1$.Other cases could be readily analyzed.

The first policy consists of a reduction in the costs of acquiring managerial capital λ. A reduction in λ captures, albeit in a reduced form, the effects of two classes of policies: those promoting entry of new firms such as better business climate, simpler bureaucratic processes, better availability of credit for new firms, etc; and policies promoting efficiency of established firms such as on-the-job training for managers, lower costs of managerial capital acquisition, and educational policies enhancing entrepreneurship. A reduction in λ decreases the managerial talent cutoff level, a_T^*, causing a reallocation of individuals from the traditional to the modern sector; lowers the rate of unemployment; increases GDP which is directly proportional to aggregate expenditure E; and deteriorates income distribution as entrepreneurs acquire more managerial capital. Since p_T does not change and E increases, equation (23) implies that a reduction in λ raises aggregate welfare.

What is the impact of this job-creating policy on international competitiveness? Note that an economy with a lower cost of managerial capital λ exhibits a lower autarky price p_A as indicated by equation (28). Consequently, the effect of a lower λ on international competitiveness is conditional on the initial trade pattern, and thus ambiguous. Specifically, where the economy exports the traditional good, a decline in λ hurts international competitiveness; and where the economy exports the modern good, a reduction in λ increases the volume of trade and enhances international competitiveness. In other words, the beneficial effects of a reduction in the costs of acquiring managerial capital do not necessarily lead to an improvement in international competitiveness.

We now turn to the effects of another job-creating labor market policy consisting of subsidizing the costs of posting vacancies in the modern sector resulting in lower τ_2. This policy reduces hiring costs c_2 and increases the job-finding rate ζ_2. A decrease in labor-market tightness τ_2 leads to a reduction in the cutoff level of managerial talent a_T^*, inducing individuals to move from traditional to modern sector, and resulting in higher aggregate expenditure E and a deterioration in the distribution of income. Since $\mathrm{w}_2 = c_2$, this policy reduces the ex-post worker income in the modern sector leading to two consequences: first, income inequality between entrepreneurs and workers in the modern sector increases more than the increase in the income inequality when λ falls; second, income inequality between workers in the traditional and modern sectors increases as well. Under our maintained assumption $\zeta_2 > \zeta_1$, an increase in ζ_2 coupled with a reduction in a_T^* result in lower aggregate unemployment according to (17). Accordingly, lowering vacancy costs in the modern sector constitutes another recovery policy because it raises aggregate expenditure and reduces unemployment. The effects of this policy on international competitiveness are identical to that of a reduction in λ: an economy with lower τ_2 and c_2 exhibits lower autarky price p_A. Where the economy exports the traditional good, a reduction in τ_2 deteriorates international competitiveness; and where the economy exports the modern good, a reduction in τ_2 enhances international competitiveness. Finally, a reduction in τ_2 leads to lower hiring costs c_2 and higher aggregate welfare according to (22) and (23).

Proposition 3. *Consider the case where the modern sector is job-friendly (i.e., $\zeta_2 > \zeta_1$). A job-creating policy lowering the costs of managerial capital λ or reducing frictions in the modern sector (τ_2)*

a. lowers aggregate unemployment;

b. increases aggregate expenditure and GDP;

c. raises aggregate welfare;

d. increases income inequality between entrepreneurs and workers and between employed workers across sectors.

e. improves (worsens) international competitiveness if the economy exports the modern (traditional) good.

These results are consistent with the generalized theory of distortions. Since the main distortion stems from labor-market frictions, improvements in international competitiveness are second-best in nature and their effects are conditioned by the economy's initial equilibrium.

3.2 A Global Jobless Economy

In this section, we analyze a world economy consisting of two trading countries, Home and Foreign. We investigate the role of cross-country differences in labor market rigidities and costs of managerial capital as sources of comparative advantage. In addition, we investigate the effects of a move from autarky to free trade. Finally, we assume that preferences and production functions (except the one associated with acquisition of managerial capital) are identical between the two countries.

Under these assumptions, equilibrium condition (27) indicates that in autarky Home and Foreign have the same managerial talent cutoff levels, i.e. $a^*_{AH} = a^*_{AF} = a^*_A$. As a result, equation (28) implies that Home produces good 2 cheaper in autarky than Foreign (i.e., $p_{AH} < p_{AF}$) if the following inequality holds

$$f_H \equiv \tau_{1H}^{-\delta}\tau_{2H}^{\frac{\eta}{1+\gamma}}\lambda_H^{\frac{1-\eta}{2}} < \tau_{1F}^{\delta}\tau_{2F}^{-\eta}\lambda_F^{\frac{1-\eta}{2}} \equiv f_F, \tag{31}$$

where $\delta = \eta/(1+\gamma) + 2/[\gamma(1-\eta)] > 0$ is an inconsequential constant. Parameter f_j ($j = H, F$) captures country j's relative cost advantage in production of good 2 which is reflected on its autarky price. In other words, comparative advantage in the present model depends on relative costs of managerial capital acquisition captured by parameter λ and the degree of labor-market frictions captured by tern $\tau_2^{\eta/(1+\gamma)}/\tau_1^{\delta}$. Thus, ceteris paribus, each country exports the good exhibiting lower relative labor market frictions. Without loss of generality, in what follows we assume that inequality (31) holds so that Home has comparative advantage and exports good 2.

3.2.1 Equilibrium in the Global Economy

Having identified the sources of comparative advantage, we now analyze the properties of free-trade equilibrium between these two countries assuming balanced trade. As in the small-open- economy case, balanced-trade implies $Y_{1j} - C_j + p_T Y_{2j} = Q_{1j} + p_T Q_{2j} = E_j$, where Q_{ij} is the total quantity of good i consumed in country j; C_j is the total cost of hiring workers and acquiring managerial capital in country j (measured in terms of good 1); p_T is the common free-trade price of good 2; and E_j is aggregate expenditure, given by (22).

In equilibrium, markets for goods must clear:

$$Q_{1H} + Q_{1F} = Y_{1H} - C_H + Y_{1F} - C_F, \tag{32a}$$

$$Q_{2H} + Q_{2F} = Y_{2H} + Y_{2F}, \tag{32b}$$

stating that global demand for each good must equal its net global supply.

Substituting $Q_{2j} = \beta E_j$ from (2) and Y_{2j} from (18b) into market-clearing condition (32b) yields

$$\sum_{j=H,F} \frac{\mathbb{E}[a \geqslant a_j^*]}{a_j^*} = B \sum_{j=H,F} G(a_j^*), \tag{33}$$

where B is given by (27). Equation (33) constitutes a generalization of the closed-economy equilibrium condition (27). Since the cutoff level a_j^* is a decreasing function of p, as indicated by equation (11), the LHS of (33) increases with p, whereas the RHS decreases with p. Thus, the above condition yields a unique solution for the equilibrium relative price of good 2 (p_T) in the world market. Substituting p_T into equation (11) leads to a unique managerial ability cutoff a_j^* for each country. In addition, using the assumption (31) ensures that $a_H^* < a_F^*$, that is, more individuals choose to become entrepreneurs in Home.

Lemma 4. *Suppose that $f_H < f_F$ holds so that the relative price of good 2 is lower in Home than Foreign. Then there exists a solution (a^*_H, a^*_F) satisfying equilibrium condition (33) which is unique and implies that $a^*_H < a^*_F$.*

Because $p_{AH} < p_T < p_{AF}$ it follows from equation (11) that a move from autarky to free trade decreases the cutoff level of managerial talent in Home and raises it in Foreign. This result has two implications. First, Home produces more of good 2 and exports it; whereas Foreign expands production and exports good 1. Formally, consider net exports of good 2 in country j : $p_T(Y_{2j} - Q_{2j})$. Using equations (18b) and $p_T Q_{2j} = \beta E_j$, where E_j is given by (22), implies

$$p_T(Y_{2j} - Q_{2j}) = \frac{\beta\zeta_1}{2}\left[\frac{\mathbb{E}[a \geqslant a^*_j]}{Ba^*_j} - G(a^*_j)\right], \tag{34}$$

where B is given by (27). Since $a^*_H < a^*_F$, equation (34) then implies that $Y_{2H} - Q_{2H} > Y_{2F} - Q_{2F}$. This combined with market-clearing condition (32b) leads to $Y_{2H} - Q_{2H} > 0$ and $Y_{2F} - Q_{2F} < 0$, i.e. Home exports good 2 and Foreign exports good 1.

Next, we analyze the impact of trade on income distribution, unemployment, and welfare in each country. The relative price of good 2 (p_H) increases as Home moves form autarky to free trade. Following the same steps in the previous section, we conclude that the impact of trade liberalization on Home is the same as its impact on the small open economy. A move from autarky to free trade leads to a decline in p_F ; and as a result, trade liberalization has opposite effects on managerial capital, income distribution, and unemployment (assuming that $\zeta_{2F} > \zeta_{1F}$) in Foreign. Finally, according to Figure 1, $p_T < p_{AF}$ implies that trade liberalization improves the aggregate welfare for Foreign.[23] The following proposition summarizes these results.

[23] Although the asymmetric impact of trade on income distribution across countries is consistent with the Stolper-Samuelson theorem, this prediction is at odds with several empirical studies that have documented that many of the less developed countries have also experienced rising inequality after opening to trade (e.g., Caron et al., 2011). Markusen (2010) shows that introduction of non-homothetic preferences into the standard Heckscher-Ohlin model can generate raising inequality in both countries. Extending our model by incorporating non-homothetic preferences is left for future work.

Proposition 4. *A move from autarky to global free trade*

a. *leads to a divergence of managerial capital between Home and Foreign: it increases (decreases) the distribution of managerial capital both at extensive and intensive margins in Home (Foreign).*

b. *increases (decreases) income inequality between entrepreneurs and workers in Home (Foreign).*

c. *lowers (raises) unemployment rate in Home (Foreign) iff $\zeta_{2H} > \zeta_{1H}$ ($\zeta_{2F} > \zeta_{1F}$).*

d. *has an ambiguous effect on aggregate welfare in Home and a beneficial welfare effect on Foreign.*

The novel prediction that trade may reduce welfare in one country differs from one of the main results obtained by Helpman and Itskhoki (2010) and Helpman et al. (2010). These seminal studies find that trade improves welfare in both countries despite the presence of labor market rigidities leading to search-based unemployment. In the present model, individuals endogenously choose to become workers or managers. As discussed in section 2.7, the prospect of unemployment among workers combined with the degree of diminishing returns in managerial capital makes the relative price of good 2 in autarky lower than the price that minimizes aggregate welfare. Thus, an increase in the relative price of good 2 in Home, caused by a move from autarky to free trade, may reduce welfare.

We now turn to analyze the impact of the unilateral job-creating policies on income distribution and welfare in each country. As in the small open economy, we consider two cases: a reduction in cost parameter λ[24] and a reduction in labor-market rigidities in the modern sector τ_2. A reduction in λ_j or τ_j lowers f_j. In what follows, without loss of generality, we assume a reduction in these parameters is not substantial so that the comparative

[24] This exercise complements Unel (2012) who investigates the impact of a unilateral change in the cost of forming human capital on inequality and welfare in each country when there are no labor market frictions in either country.

advantage condition (31) still holds, i.e. $f_H < f_F$. The following lemma summarizes the impact of such policies on the equilibrium ability cutoff a_j^* in each country (see Appendix for its proof).[25]

Lemma 5. *Consider two freely trading countries, Home and Foreign, as described. A unilateral job-creating policy adopted by Home (in the form of a reduction in λ_H or τ_{2H}) decreases the equilibrium managerial talent cutoff level a_H^* in Home, while increasing the corresponding cutoff level a_F^* in Foreign.*

Since the fraction of individuals working in the modern sector decreases with the managerial cutoff level, a unilateral job-creating policy Home induces more workers to move to its modern sector. In addition, equation (12) implies that more individuals choose to become entrepreneur at Home and each entrepreneur acquires more managerial capital. Although Home aggregate income increases, a decrease in managerial cutoff level a_H^* increases the income gap between entrepreneurs and workers as indicated by (21). The impact of this unilateral-job creating policy on the formation of managerial capital and income distribution on Foreign is just the opposite. Appendix shows formally that a unilateral job-creating policy reduces the world relative price of good 2, p_T. Since aggregate welfare is a U–shape function of p_T, a reduction in p_T improves Foreign welfare, while leading an ambiguous effect on Home welfare.

Finally, consider the impact of a unilateral job-creating policy on aggregate unemployment rates. To avoid unnecessary repetition, we assume that job-findings rate in the modern sector is greater than that in the traditional sector, i.e. $\zeta_{2j} > \zeta_{1j}$ for $j = H, F$. Lemma 5 implies that a unilateral job-creating policy adopted by Home decreases the managerial cutoff level a_H^* and increases the share of labor force in the modern sector $N_2/a^*G(a^*)$. Consequently, such a policy lowers aggregate unemployment in Home Since the managerial cutoff

[25] In Lemma 3, without loss of generality, we consider a unilateral job-creating policy adopted by Home. A unilateral job-creating policy adopted by Foreign, on the other hand, decreases a_F^* in Foreign, while increasing a_H^* in Home as shown in Appendix.

level increases in Foreign without affecting the job-finding rates, a unilateral job-creating policy adopted by Home raises unemployment at it trading partner!

Proposition 5. *Consider two freely trading countries, Home and Foreign, as described. Suppose that $\zeta_{2j} > \zeta_{1j}$ for $j = H, F$. A unilateral job-creating policy adopted by Home (in the form of a reduction in λ or τ)*

a. *increases (decreases) the distribution of managerial capital both at extensive and intensive margins in Home (Foreign).*

b. *increases (decreases) income inequality between entrepreneurs and workers in Home (Foreign).*

c. *lowers (raises) unemployment rate in Home (Foreign).*

d. *has an ambiguous (positive) effects on Home (Foreign) welfare.*

4 Concluding Remarks

We developed a simple theory highlighting the complex interactions among personal income distribution, firm heterogeneity, search unemployment, and globalization. The key features of the theory consist of heterogeneous individuals differing in managerial talent, perfectly competitive product markets, and imperfect labor markets with search-based equilibrium unemployment. Each individual chooses optimally to become a worker facing the prospect of unemployment or to start her own business as a self-employed entrepreneur.

The assumption of perfectly competitive product markets provides considerable analytical mileage. It permits the use of a small-open economy framework to analyze the effects of improvements in international competitiveness, and job-creating policies stemming from reductions in managerial-capital and job-vacancy costs. Improvements in international competitiveness raise the possibility of immiserizing, jobless, and unfair recoveries with higher unemployment, higher GDP, lower welfare and worse personal income distribution. Reductions in the costs of acquiring managerial capital or appropriate job-vacancy subsidies generally lead to lower unemployment, higher GDP, higher aggregate welfare, and higher income for entrepreneurs leading to a deterioration in personal income distribution. We also analyze the role of managerial capital costs and sector-specific labor market frictions as determinants of comparative advantage. We find that, ceteris paribus, a country exports the good exhibiting lower labor-market frictions and or lower costs of acquiring managerial capital. We also establish that unilateral job-creating policies may increase aggregate unemployment in trading partners.

Appendix

Proof of Lemma 5

Note that a reduction in τ_j implies a reduction c_j, and thus we hereafter assume a reduction in c_{2j}. Let x_j denote λ_j or c_{2j}, and without loss of a generality, suppose that there is a reduction in x_F. Totally differentiating (33) with respect to x_F yields

$$\sum_j \Gamma_j \frac{da_j^*}{dx_F} = 0, \qquad \Gamma_j = (1+B)g(a_j^*) + \frac{\mathbb{E}[a \geqslant a_j^*]}{a_j^{*2}}. \tag{35}$$

where B is given by (27).

Differentiating (11) with respect to λ_F and c_{2F} yields

$$\frac{da_H^*}{d\lambda_F} = -\frac{2a_H^*}{(1-\eta)p_T}\frac{dp_T}{d\lambda_F}, \qquad \frac{da_F^*}{d\lambda_F} = \frac{a_F^*}{\lambda_F} - \frac{2a_F^*}{(1-\eta)p_T}\frac{dp_T}{d\lambda_F} \tag{36a}$$

$$\frac{da_H^*}{dc_{2F}} = -\frac{2a_H^*}{(1-\eta)p_T}\frac{dp_T}{dc_{2F}}, \qquad \frac{da_F^*}{dc_F} = \frac{2\eta a_F^*}{(1-\eta)c_{2F}} - \frac{2a_F^*}{(1-\eta)p_T}\frac{dp_T}{dc_{2F}}, \tag{36b}$$

where p_T is the international price of good 2. Substituting these into (35) and rearranging terms yields

$$\frac{dp_T}{d\lambda_F} = \frac{(1-\eta)\Gamma_F a_F^* p_T}{2\lambda_F \sum_j \Gamma_j a_j^*} > 0, \tag{37a}$$

$$\frac{dp_T}{dc_{2F}} = \frac{\eta \Gamma_F a_F^* p_T}{c_{2F}\lambda_F \sum_j \Gamma_j a_j^*} > 0. \tag{37b}$$

The first equations in (36a) and (36b) then yields $da_H^*/dx_F < 0$ for $x_F = \lambda_F, c_{2F}$. Substituting these equations into the the second equations in (36a) and (36b), on the other hand, yields

$$\frac{da_F^*}{d\lambda_F} = \frac{a_F^* a_H^* \Gamma_H}{\lambda_F \sum_j \Gamma_j a_j^*} > 0, \qquad \frac{da_F^*}{dc_{2F}} = \frac{2\eta a_F^* a_H^* \Gamma_H}{(1-\eta)c_{2F}\sum_j \Gamma_j a_j^*} > 0. \tag{38}$$

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